

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. [Original] A multi-wavelength photonic oscillator comprising:
 - (a) a plurality of lasers each emitting light at a different frequency;
 - (b) an optical wavelength multiplexer for combining the light emitted by the plurality of lasers at an output thereof as a set of optical wavelengths; and
 - (c) an optical modulator arranged in a feedback loop and coupled to receive light at the output of the optical wavelength multiplexer, the feedback loop further including:
 - (i) an optical tap for coupling at least a subset of said set of optical wavelengths to at least one optical output of the multi-wavelength photonic modulator;
 - (ii) at least one optical channel having an associated photodetector arranged to receive light from the optical tap via the at least one optical channel; and
 - (iii) an electronic loop portion coupled to receive output from the at least one associated photodetector and to provide an input for the optical modulator.
2. [Original] The multi-wavelength photonic oscillator of claim 1 wherein the feedback loop has a plurality of optical channels with one optical channel imposing more delay than another optical channel with each associated

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photodetector in the plurality of optical channels having an output combined at a common electrical output for connection to said electronic loop portion.

3. [Original] The multi-wavelength photonic oscillator of claim 2 wherein at least one of an optical portion of the loop and the electronic loop portion includes an amplifier to ensure that a loop gain for the feedback loop exceeds unity.

4. [Original] The multi-wavelength photonic oscillator of claim 3 wherein at least one of the optical portion of the loop and the electronic loop portion includes phase shifting means.

5. [Original] The multi-wavelength photonic oscillator of claim 4 wherein the electronic loop portion includes a bandpass filter and wherein the input for the optical modulator is an electronic input.

6. [Original] The multi-wavelength photonic oscillator of claim 1 wherein the optical tap is wavelength sensitive for directing light of a wavelength associated with a frequency of one of the lasers of said plurality of lasers into said feedback loop and for directing light of wavelengths associated with frequencies of other ones of the lasers of said plurality of lasers to said at least one optical output of the multi-wavelength photonic modulator.

7. [Original] The multi-wavelength photonic oscillator of claim 6 wherein the feedback loop has a plurality of

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optical channels with one optical channel imposing more delay than another optical channel with each associated photodetector in the plurality of optical channels having an output combined at a common electrical output for connection to said electronic loop portion.

8. [Original] The multi-wavelength photonic oscillator of claim 7 wherein at least one of an optical portion of the loop and the electronic loop portion includes an amplifier to ensure that a loop gain for the feedback loop exceeds unity.

9. [Original] The multi-wavelength photonic oscillator of claim 8 wherein at least one of the optical portion of the loop and the electronic loop portion includes phase shifting means.

10. [Original] The multi-wavelength photonic oscillator of claim 9 wherein the electronic loop portion includes a bandpass filter and wherein the input for the optical modulator is an electronic input.

11. [Original] The multi-wavelength photonic oscillator of claim 1 wherein said feedback loop includes a plurality of parallel-arranged optical channels and wherein the optical tap is wavelength sensitive for directing light of wavelengths associated with frequencies of said plurality of lasers each into different ones of optical channels of said feedback loop.

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12. [Original] The multi-wavelength photonic oscillator of claim 11 wherein at least one of the optical channels imposes more delay than at least another one of the optical channels, each optical channel having an associated photodetector with a photodetector output, the outputs of the photodetectors in said optical channels being combined at a common electrical output for connection to said electronic loop portion.

13. [Original] The multi-wavelength photonic oscillator of claim 12 wherein at least one of an optical portion of the loop comprising said optical channels and the electronic loop portion includes an amplifier to ensure that a loop gain for the feedback loop exceeds unity.

14. [Original] The multi-wavelength photonic oscillator of claim 13 wherein each optical channel in the optical portion of the loop has an optical amplifier.

15. [Original] The multi-wavelength photonic oscillator of claim 13 wherein at least one of the optical portions of the loop and the electronic loop portion includes phase shifting means.

16. [Original] The multi-wavelength photonic oscillator of claim 15 wherein each optical channel in the optical portion of the loop has an optical amplifier and phase shifting means.

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17. [Original] The multi-wavelength photonic oscillator of claim 16 wherein the electronic loop portion includes a bandpass filter.

18. [Original] The multi-wavelength photonic oscillator of claim 1 in combination with:

(d) a wavelength division demultiplexer coupled to the at least one optical output of the multi-wavelength photonic oscillator; and

(e) a plurality of slave lasers arranged as pairs of slave lasers, each pair of slave lasers being wavelength-associated with a laser of said plurality of lasers in said multi-wavelength photonic oscillator and being coupled to said multi-wavelength photonic oscillator via said wavelength division demultiplexer.

19. [Original] The apparatus of claim 18 wherein one slave laser in each said pair of slave lasers is set so that its free-running wavelength matches a modulation sideband in the optical signal supplied by the multi-wavelength photonic oscillator.

20. [Original] The apparatus of claim 19 wherein the other slave laser in each said pair of slave lasers is set so that its free-running wavelength matches a different modulation sideband in the optical signal supplied by the multi-wavelength photonic oscillator.

21. [Original] The apparatus of claim 18 wherein one slave laser in each said pair of slave lasers is set so that its free-running wavelength matches a carrier frequency in the

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optical signal supplied by the multi-wavelength photonic oscillator.

22. [Original] The apparatus of claim 21 wherein the other slave laser in each said pair of slave lasers is set so that its free-running wavelength matches a modulation sideband in the optical signal supplied by the multi-wavelength photonic oscillator.

23. [Original] The apparatus of claim 18 in combination with a radar or other communication system having optical modulators for modulating signals transmitted thereby, the pairs of slave lasers each producing a local oscillator signal for modulation by the optical modulators in said radar or other communication system.

24. [Currently amended] A transmitter comprising:

(a) optical modulators for modulating optical local oscillator signals;

(b) photodetectors coupled to outputs of the optical modulators for converting the modulated optical local oscillator signals to electrical radio frequency signals for subsequent application to antenna elements; and

(c) an apparatus for generating the optical local oscillator signals comprising:

(i) multi-wavelength photonic oscillator, said multi-wavelength photonic oscillator producing an optical output comprising multiple optical carriers and multiple modulation sidebands, said multiple optical carriers and multiple modulation sidebands being grouped into more than one wavelength region with the optical output at each

wavelength region comprising at least an optical carrier and a modulation sideband; and

(ii) a wavelength division demultiplexer coupled to an optical output of the multi-wavelength photonic oscillator, said wavelength division demultiplexer separating the optical output of the multi-wavelength photonic oscillator into more than one of said wavelength regions, with the optical output at each wavelength region comprising at least an optical carrier and a modulation sideband, the output at each wavelength region being suitable for determining a local oscillator frequency.

25. [Currently amended] The transmitter of claim 24 wherein the apparatus for generating the optical local oscillator signals further comprises a plurality of slave lasers arranged as pairs of slave lasers, each pair of slave lasers being wavelength-associated with a particular one of said wavelength regions of said said multi-wavelength photonic oscillator and being coupled to said multi-wavelength photonic oscillator via said wavelength division demultiplexer.

26. [Currently amended] A ~~The transmitter of claim 25 comprising:~~

(a) optical modulators for modulating optical local oscillator signals;

(b) photodetectors coupled to outputs of the optical modulators for converting the modulated optical local oscillator signals to electrical radio frequency signals for subsequent application to antenna elements; and

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(c) an apparatus for generating the optical local oscillator signals comprising:

(i) multi-wavelength photonic oscillator;

(ii) a wavelength division demultiplexer coupled to an optical output of the multi-wavelength photonic oscillator, said wavelength division demultiplexer separating the optical output of the multi-wavelength photonic oscillator into more than one wavelength region, with the optical output at each wavelength region comprising at least an optical carrier and a modulation sideband, the output at each wavelength region being suitable for determining a local oscillator frequency; and

(iii) a plurality of slave lasers arranged as pairs of slave lasers, each pair of slave lasers being wavelength-associated with a particular wavelength region of said multi-wavelength photonic oscillator and being coupled to said multi-wavelength photonic oscillator via said wavelength division demultiplexer, and wherein one slave laser in each said pair of slave lasers is set so that its free-running wavelength matches a modulation sideband in an optical signal supplied by the multi-wavelength photonic oscillator.

27. [Original] The transmitter of claim 26 wherein the other slave laser in each said pair of slave lasers is set so that its free-running wavelength matches a different modulation sideband in the optical signal supplied by the multi-wavelength photonic oscillator.

28. [Currently amended] The transmitter of claim 26 25 wherein one the other slave laser in each said pair of

slave lasers is set so that its free-running wavelength matches a carrier frequency in an optical signal supplied by the multi-wavelength photonic oscillator.

29. Cancelled.

30. [Original] The transmitter of claim 24 wherein the multi-wavelength photonic oscillator comprises:

(1) a plurality of lasers each emitting light at a different frequency;

(2) an optical wavelength multiplexer for combining the light emitted by the plurality of lasers at an output thereof as a set of optical wavelengths; and

(3) an optical modulator arranged in a feedback loop and coupled to receive light at the output of the optical wavelength multiplexer, the feedback loop further including: an optical tap for coupling at least a subset of said set of optical wavelengths to at least one optical output of the multi-wavelength photonic modulator; at least one optical channel having an associated photodetector arranged to receive light from the optical tap via the at least one optical channel; and an electronic loop portion coupled to receive output from the at least one associated photodetector and to provide an input for the optical modulator.

31. [Currently amended] A receiver comprising:

(a) optical modulators for modulating optical local oscillator signals;

(b) photodetectors coupled to outputs of the optical modulators for converting the modulated optical local

oscillator signals to an electrical intermediate frequency or baseband signal for subsequent processing; and

(c) an apparatus for generating the optical local oscillator signals comprising:

(i) multi-wavelength photonic oscillator, said multi-wavelength photonic oscillator producing an optical output comprising multiple optical carriers and multiple modulation sidebands, said multiple optical carriers and multiple modulation sidebands being grouped into more than one wavelength region with the optical output at each wavelength region comprising at least an optical carrier and a modulation sideband; and

(ii) a wavelength division demultiplexer coupled to an optical output of the multi-wavelength photonic oscillator, said wavelength division demultiplexer separating the optical output of the multi-wavelength photonic oscillator into more than one of said wavelength regions, with the optical output at each wavelength region comprising at least an optical carrier and a modulation sideband, the output at each wavelength region being suitable for determining a local oscillator frequency.

32. [Currently amended] The receiver of claim 31 wherein the apparatus for generating the optical local oscillator signals further comprises a plurality of slave lasers arranged as pairs of slave lasers, each pair of slave lasers being wavelength-associated with a particular one of said wavelength regions of said said multi-wavelength photonic oscillator and being coupled to said multi-wavelength photonic oscillator via said wavelength division demultiplexer.

33. [Currently amended] The A receiver of claim 32 comprising:

(a) optical modulators for modulating optical local oscillator signals;

(b) photodetectors coupled to outputs of the optical modulators for converting the modulated optical local oscillator signals to an electrical intermediate frequency or baseband signal for subsequent processing; and

(c) an apparatus for generating the optical local oscillator signals comprising:

(i) multi-wavelength photonic oscillator; and

(ii) a wavelength division demultiplexer coupled to an optical output of the multi-wavelength photonic oscillator, said wavelength division demultiplexer separating the optical output of the multi-wavelength photonic oscillator into more than one wavelength region, with the optical output at each wavelength region comprising at least an optical carrier and a modulation sideband, the output at each wavelength region being suitable for determining a local oscillator frequency; and

(iii) a plurality of slave lasers arranged as pairs of slave lasers, each pair of slave lasers being wavelength-associated with a particular wavelength region of said multi-wavelength photonic oscillator and being coupled to said multi-wavelength photonic oscillator via said wavelength division demultiplexer, and wherein one slave laser in each said pair of slave lasers is set so that its free-running wavelength matches a modulation sideband in an optical signal supplied by the multi-wavelength photonic oscillator.

34. [Original] The receiver of claim 33 wherein the other slave laser in each said pair of slave lasers is set so that its free-running wavelength matches a different modulation sideband in the optical signal supplied by the multi-wavelength photonic oscillator.

35. [Currently amended] The receiver of claim 33 32 wherein ~~one~~ the other slave laser in each said pair of slave lasers is set so that its free-running wavelength matches a carrier frequency in an optical signal supplied by the multi-wavelength photonic oscillator.

36. Cancelled.

37. [Original] The receiver of claim 31 wherein the multi-wavelength photonic oscillator comprises:

(1) a plurality of lasers each emitting light at a different frequency;

(2) an optical wavelength multiplexer for combining the light emitted by the plurality of lasers at an output thereof as a set of optical wavelengths; and

(3) an optical modulator arranged in a feedback loop and coupled to receive light at the output of the optical wavelength multiplexer, the feedback loop further including:

an optical tap for coupling at least a subset of said set of optical wavelengths to at least one optical output of the multi-wavelength photonic modulator;

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at least one optical channel having an associated photodetector arranged to receive light from the optical tap via the at least one optical channel; and

an electronic loop portion coupled to receive output from the at least one associated photodetector and to provide an input for the optical modulator.